CLAIMS

1. A high speed spindle motor comprising:

a) a stator assembly comprising:

i) a stator having multiple conductors that create a plurality of magnetic fields when electrical current is conducted by the conductors; and

ii) a body of a phase change material substantially encapsulating the stator;

b) a rotatable hub having a magnet connected thereto in operable proximity to the stator;

c) a shaft;

d) a bearing around the shaft; and

e) one of the shaft or bearing being fixed to the stator assembly and the other of the shaft or bearing being fixed to the rotatable hub.

2. The high speed spindle motor of claim 1 wherein the body of phase change material is a monolithic body.

3. The high speed motor of claim 1 wherein the bearing is fixed to the stator assembly.

4. The high speed motor of claim 3 wherein the bearing is fixed to the body.

5. The high speed motor of claim 1 wherein the shaft is fixed to the hub.

6. The high speed motor of claim 4 wherein the magnet is fixed to the hub.

7. The high speed motor of claim 5 wherein the magnet is fixed to the shaft which in turn is fixed to the hub.

8. The high speed motor of claim 1 wherein the shaft is fixed to the stator assembly.

9. The high speed motor of claim 8 wherein the stator further comprises a core and the conductors induce magnetic fields in the core when current is conducted by the conductors.

10. The high speed motor of claim 9 wherein the core comprises steel laminations.

11. The high speed motor of claim 9 wherein the core has a plurality of poles and the conductors comprise windings around said poles.

12. The high speed motor of claim 1 wherein the conductors comprise a plurality of windings.

13. The high speed motor of claim 12 wherein the spindle motor comprises a pancake motor and the conductors comprise windings mounted on a circuit board.

14. The high speed motor of claim 1 wherein the conductors comprise electrical traces on a circuit board.

15. The high speed motor of claim 1 wherein the hub comprises a hard drive disc support member.

16. The high speed motor of claim 1 wherein the motor is able to operate at over 5000 rpm.

17. The high speed motor of claim 1 wherein the motor is able to operate at at least 7500 rpm.

18. The high speed motor of claim 1 wherein the motor is able to operate at at least 10,000 rpm.

19. The high speed motor of claim 1 wherein the magnet connected to the hub is a permanent magnet.

20. The high speed motor of claim 1 wherein the bearing includes an upper bearing and a lower bearing.

21. The high speed motor of claim 20 wherein the body surrounds the upper bearing and the lower bearing.

22. The high speed motor of claim 1 wherein the stator assembly further comprises terminals for connecting the conductors to a power source external to the motor.

23. The high speed motor of claim 22 wherein the terminals are partially encapsulated within the body.

24. The high speed motor of claim 1 wherein apertures are formed within the body for mounting the high speed motor to a hard disc drive.

25. The high speed motor of claim 1 wherein the magnet is concentrically disposed around the stator.

26. The high speed motor of claim 1 wherein the bearing comprises ball bearings.

27. The high speed motor of claim 26 wherein the bearings comprise oversized bearings having an outer diameter of over 13 mm.

28. The high speed motor of claim 1 wherein the bearing is a hydrodynamic bearing.

29. The high speed motor of claim 1 wherein the stator concentrically surrounds the magnet.

30. The high speed motor of claim 1 wherein the phase change material comprises a material that changes from a liquid to a solid due to a change in temperature.

31. The high speed motor of claim 30 wherein the phase change material comprises a thermoplastic material.

32. The high speed motor of claim 30 wherein the phase change material comprises a thermosetting material.

33. The high speed motor of claim 30 wherein the phase change material comprises a material that changes from a liquid to a solid due to a chemical reaction.

34. The high speed motor of claim 33 wherein the phase change material comprises an epoxy.

35. The high speed motor of claim 1 wherein the stator and magnet are generally coplanar.

36. The high speed motor of claim 1 wherein a solid insert is substantially encapsulated within the body.

37. The high speed motor of claim 36 wherein the insert provides structural rigidity to the stator assembly.

38. The high speed motor of claim 36 wherein the insert enhances heat transfer away from the bearing and the stator.

39. The high speed motor of claim 1 wherein a first portion of a magnetic bearing is substantially encapsulated within the body and a second opposing portion of the magnetic bearing is attached to the hub.

40. The high speed motor of claim 39 wherein the body has been machined to provide precise tolerance between the first and second portions of the magnetic bearing.

41. The high speed motor of claim 36 wherein the insert enhances dampening of motor vibration.

42. The high speed motor of claim 36 wherein the insert enhances dampening of audible noise.

43. The high speed motor of claim 36 wherein the shaft is fixed to the body and the insert is positioned between the shaft and the bearing.

44. The high speed motor of claim 43 wherein the bearing comprises an oversized bearing having an outer diameter of over 13 mm.

45. The high speed motor of claim 1 wherein an enhancement magnet is substantially encapsulated within the body.

46. The high speed motor of claim 1 wherein a thermoplastic material is injection molded to form the body.

47. The high speed motor of claim 46 wherein the thermoplastic body is monolithic.

48. The high speed motor of claim 1 wherein the phase change material includes ceramic particles.

49. The high speed motor of claim 1 wherein the phase change material has a coefficient of linear thermal expansion of less than $2x10^{-5}$ in/in/°F throughout the range of 0-250°F.

50. The high speed motor of claim 1 wherein the phase change material has a coefficient of linear thermal expansion of less than $1.5x10^{-5}$ in/in/°F throughout the range of 0-250°F.

51. The high speed motor of claim 1 wherein the phase change material has a coefficient of linear thermal expansion of between about $0.8x10^{-5}$ in/in/°F and about $1.2x10^{-5}$ in/in/°F throughout the range of 0-250°F.

52. The high speed motor of claim 1 wherein the bearing comprises steel, the hub comprising aluminum and phase change material has a coefficient of linear thermal expansion that is between the coefficient of linear thermal expansion of the steel and the coefficient of linear thermal expansion of the aluminum.

53. The high speed motor of claim 1 wherein the phase change material has a thermal conductivity of at least 0.7 watts/meter°K at 23°C.

54. The high speed motor of claim 1 wherein the phase change material comprises polyphenyl sulfide.

55. The high speed motor of claim 1 wherein the phase change material has a dielectric strength of at least 250 volts/mil.

56. The high speed motor of claim 55 wherein the phase change material has a thermal conductivity of at least 0.7 watts/meter°K at 23°C

57. A high speed spindle motor comprising:

a) a stator substantially encapsulated in a thermoplastic body, the thermoplastic body having a cylindrical hole therein;

b) a bearing press fit into the cylindrical hole;

c) a shaft rotatably supported by the bearing; and

d) a hub having a magnet connected thereto, the hub being fixed to the shaft.

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